SIMPLAR FOUNDATION



Multiskilling in U.S. Construction

Findings from the largest field dataset on multiskilling to date

Volume 1 of the *Multiskilling in the U.S. Construction Industry* research series

Nearly three decades of research were favorable, but none measured effects on active U.S. projects

59 PEER-REVIEWED STUDIES, 1998 TO MID-2026

What the studies found

95% described multiskilling as valuable or emphasized its potential benefits

0 concluded it was disadvantageous

What they could not show

76% did not conduct formal hypothesis testing with inferential statistics

54% relied on modeling and simulation without field-verified inputs

0 directly measured its effects on an active U.S. project

0 compared multiskilled and single-skilled crews on the same work sequence

> **This study is the first to measure multiskilling's effects on active U.S. projects, with the largest field dataset to date.**

Multiskilling is qualified, targeted and built on depth

DEFINITION

Multiskilling

A labor strategy in which workers and crews are qualified to safely and competently perform selected work activities across more than one trade, craft, or skill classification.

QUALIFIED

Within normal training, licensing, and safety rules

TARGETED

To naturally complementary skill combinations

BUILT ON DEPTH

Added skills build on a strong primary trade

This does not mean every worker performing every trade.

EXAMPLES OF COMPLEMENTARY TRADE COMBINATIONS

- **Carpenter** + concrete placing and finishing
- **Sheet metal worker** + scaffolding, pipe insulation
- **Pipefitter** + welding
- **Ironworker** + concrete formwork
- **Electrician** + heavy equipment operation
- **Concrete finisher** + rebar tying

Seven sources of evidence, one nationwide dataset



- Fieldwork in 24 states and Washington, DC
- Interviews in five more states
- Site visits, labor records, training-facility tours and field trials

40 PROJECTS · 23 PROJECT TYPES

40
site visits to active projects

11,407
productivity observations of 644 workers

89,620
core-crew hours of labor records from 18 projects

2
controlled field trials and 120,000 simulation runs

80
interviews with 48 companies

7
training-facility tours

59
prior peer-reviewed studies reviewed

33M
employee hours of contractor safety records

Multiskilling was a routine part of the workday



36%

22 of every 60 minutes

of crew time was multiskilling, work outside a worker's primary trade, in 60 observed crews



17%

10 of every 60 minutes

of core-crew hours were multiskilling, across 18 project labor records

About 3

trades or skills used by a typical multiskilled worker, up to six in a single day

Nearly 190

distinct trade combinations documented

26

trades represented, from carpenters to substation technicians

> **With multiskilling this routine, the next question is what happens without it.**

Three tests compare multiskilled work with the same work done one trade per worker

OBSERVED CREWS

60 multiskilled crews



11,407 observations on 36 projects

CONTROLLED FIELD TRIALS

2 trials of the same assembly

2 workers

12 workers



10 handoffs, then 120,000 simulation runs

PROJECT LABOR RECORDS

18 projects



1,896 workdays, 89,620 core-crew hours

APPLY ONE RULE — **Each worker may perform only one trade. The work, the sequence and the site conditions stay the same.**

Productivity and staffing
Direct work, idle time, crew size

Productivity
Elapsed time, installed work

Schedule and staffing
Workdays, daily and peak staffing

Every performance result that follows compares the same work, done two ways.

Multiskilled crews spent 39% more time on direct work and 68% less time idle

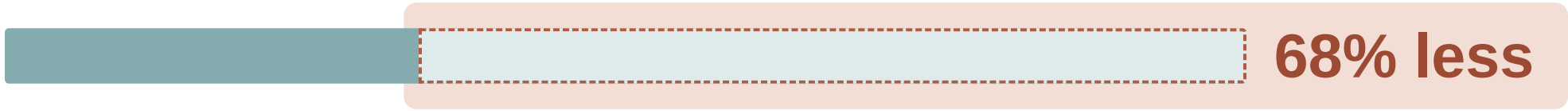
One trade only Gain with multiskilling Idle time removed with multiskilling

Direct construction work share of crew time



From about a third of crew time to about half: 13 more percentage points, about 8 more minutes of direct work per crew hour

Idle and waiting time share of crew time

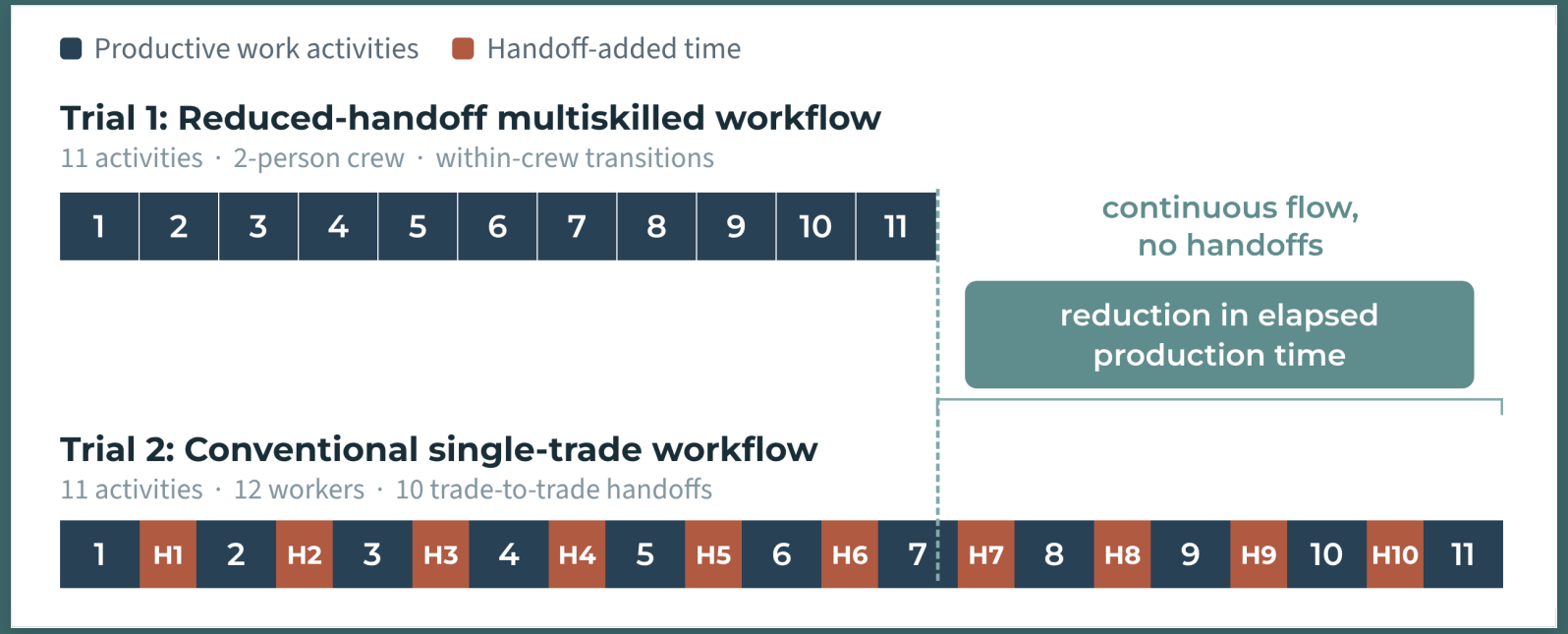


From about 45% of crew time to about 15%: 31 fewer percentage points, about 19 fewer idle minutes per crew hour

Averages across 60 observed crews. Both differences are statistically significant at the 99.9% confidence level.

> **More of the paid workday went into building the work, and far less into waiting.**

In controlled field trials and modeling, fewer handoffs meant about 43% more installed work in the same time



2 vs. 12
workers for the same seven-trade sequence

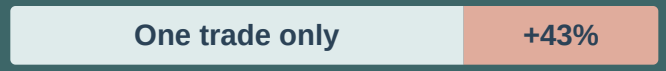
10
trade-to-trade handoffs removed

221
minutes of productive work, 11 activities

120,000
simulation runs across 12 scenarios

43%

more installed work in the same production time



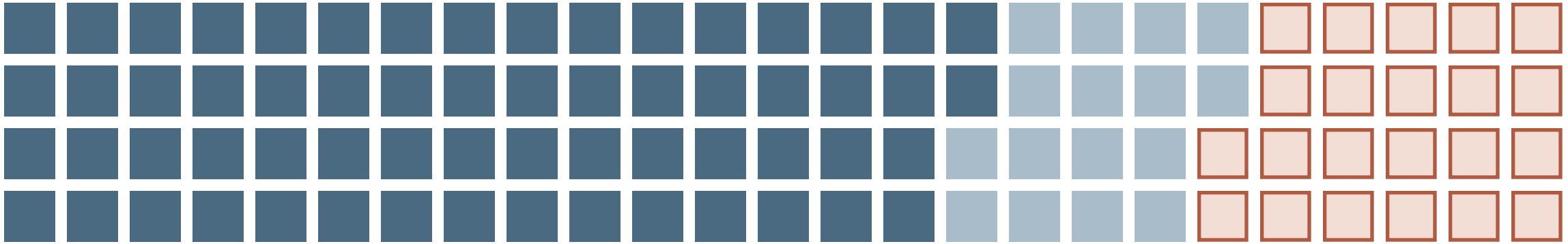
About 30% faster completion of the closely sequenced scope

The gain came from less waiting and restarting between crews, not faster work.

Multiskilled projects completed their work in 22% to 38% fewer workdays

For every 100 one-trade workdays

Multiskilled projects needed **62 to 78** = **22% to 38% schedule savings**



Labor records from 18 projects: 1,896 workdays and 89,620 core-crew hours

Limiting workers to one trade would take more workers and a taller staffing peak

CREW LEVEL · 60 OBSERVED CREWS

A crew of 10 multiskilled workers did the work of 14 to 17 workers limited to one trade

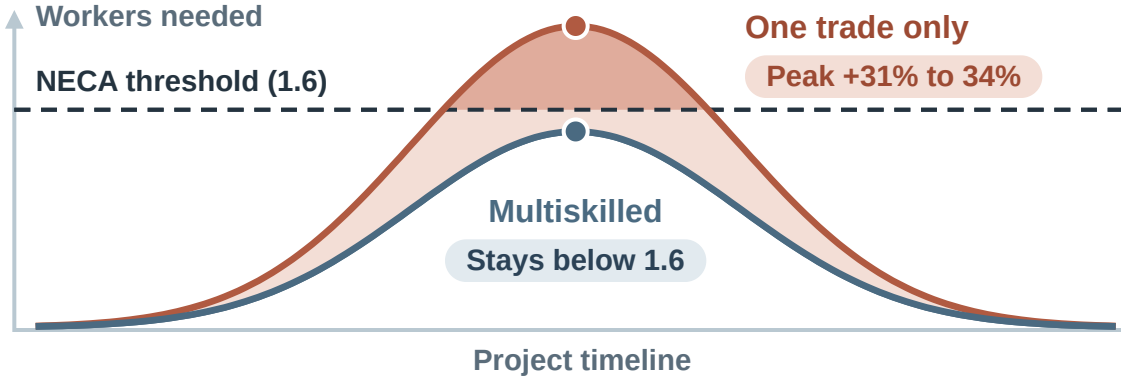


45% to 72% more workers to keep an observed crew's work sequence moving

PROJECT LEVEL · 18 LABOR RECORDS

9% to 12% more workers each day, on average

A taller peak can cost productivity



Peak staffing would reach about twice the average, a level that research by the National Electrical Contractors Association (NECA) links to a potential 15% to 20% productivity loss.

The participating contractors had safety records better than industry benchmarks

2024 SAFETY RECORDS · 15 CONTRACTORS · 33 MILLION EMPLOYEE HOURS

Recordable incident rate (TRIR)



57% better

Days away, restricted or transferred (DART)



66% better

Experience modification rate (EMR)



40% better

> **No fatalities across 33 million employee hours, and no sign of uncontrolled task switching on site.**

Multiskilling should not be mandated, and it should not be arbitrarily prohibited.

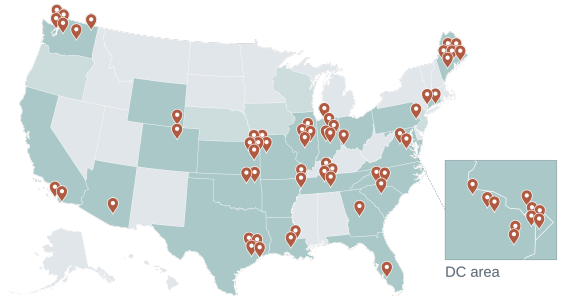
Many decisions that enable or restrict it are made before a worker reaches the site:

1	2	3	4	5
Procurement approach	**Scope packaging**	**Contract terms**	**Labor agreements**	**Classification rules**

Policymakers and public owners can preserve qualified workforce flexibility where it is safe, legal and useful, and evaluate it based on the work and the evidence.

What one nationwide study shows about multiskilling

THE EVIDENCE BASE



40 site visits

11,407 productivity observations

89,620 core-crew hours recorded

2 controlled field trials

80 interviews with 48 companies

7 training-facility tours

33M employee hours of safety records

MULTISKILLING IS ROUTINE

36%
of observed crew time was multiskilling, outside the primary trade

17%
of core-crew hours in the project labor records were multiskilling

Nearly 190
distinct trade combinations

26
trades represented in the study

carpenter, concrete finisher, drywall hanger, electrician, equipment operator, glazier, HVAC technician, insulator, ironworker (reinforcing), ironworker (structural), laborer, mason, millwright, painter, pile driver, pipefitter, plumber, rigger, roofer and waterproofer, scaffold builder, sheet metal worker, substation technician, surveyor, tile setter, truck driver, welder

RESULTS, WITH SAFETY CONTEXT

PRODUCTIVITY

39% more direct work

68% less idle time

43% more installed work on closely sequenced scopes

SCHEDULE

22% to 38% fewer workdays than a one-trade workforce would need

STAFFING

45% to 72% more workers for a one-trade crew

31% to 34% higher peak staffing if limited to one trade

SAFETY CONTEXT

57% better recordable rate for participating contractors; no fatalities

The research team: Three universities and the Simplar Foundation



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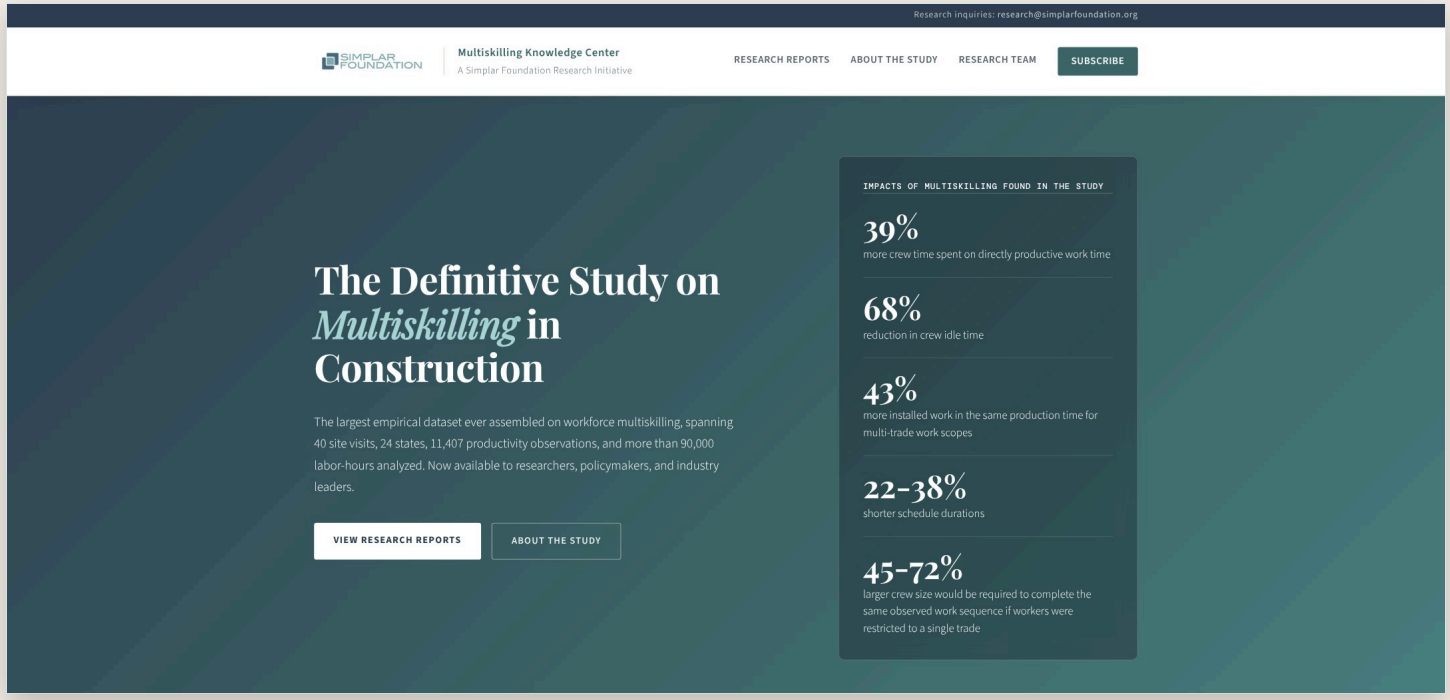
Civil, Environmental & Architectural Engineering

UNIVERSITY OF NORTH CAROLINA CHARLOTTE | ALBERT SCHOOL OF CONSTRUCTION

ASU Arizona State University

SIMPLAR FOUNDATION

Find everything at the Multiskilling Knowledge Center



SCAN OR VISIT

simplarfoundation.org/multiskilling

research@simplarfoundation.org

Six research reports
Full methods and findings, each with its own page

Video summaries
Under 2 minutes for each report

Study-at-a-glance handouts
Graphical summaries and one-pagers

Audience handouts
Practical implications, worker benefits, overall summary

Subscribe on the site for new reports, videos and resources as the research continues.

Additional information

Resources, the dataset and the results in detail, for anyone who wants to go deeper



SIMPLAR FOUNDATION

Appendices: the resources, the dataset and the detailed results

APPENDIX A

Resources

The Multiskilling Knowledge Center

- Six reports
- What each report page holds
- Three summary handouts

APPENDIX B

The dataset

Scale and reach of the evidence

- Seven sources, one dataset
- Where the fieldwork happened
- Field observations and labor records
- 26 trades, nearly 190 combinations

APPENDIX C

Results in detail

How consistent and how robust

- Benefit by multiskilling share
- How the controlled trials worked
- The 12 handoff scenarios
- Schedule under every assumption
- Staffing on every type of day
- Trade gaps and the labor curve
- Safety benchmarks

Appendix A: Resources

APPENDIX A

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Six reports cover the study in depth, each on its own page

REPORT 1 ► Video under 2 minutes

Crew-level productivity

Work-Time Utilization and Staffing Level Impacts in Construction Crews

11,407 productivity observations

REPORT 2 ► Video under 2 minutes

Head-to-head productivity comparison

Productivity in Multi-Trade Construction Workflows

2 controlled field trials

REPORT 3 ► Video under 2 minutes

Schedule and labor curve

Schedule Duration and Labor-Curve Outcomes

89,620 core-crew hours of labor records

REPORT 4 ► Video under 2 minutes

Workforce capability systems

How Construction Employers Develop, Verify, and Sustain Workforce Capability

80 interviews with 48 companies

REPORT 5 ► Video under 2 minutes

Review of multiskilling studies

A Comprehensive Review of Prior Evidence

59 prior peer-reviewed studies

REPORT 6 ► Video under 2 minutes

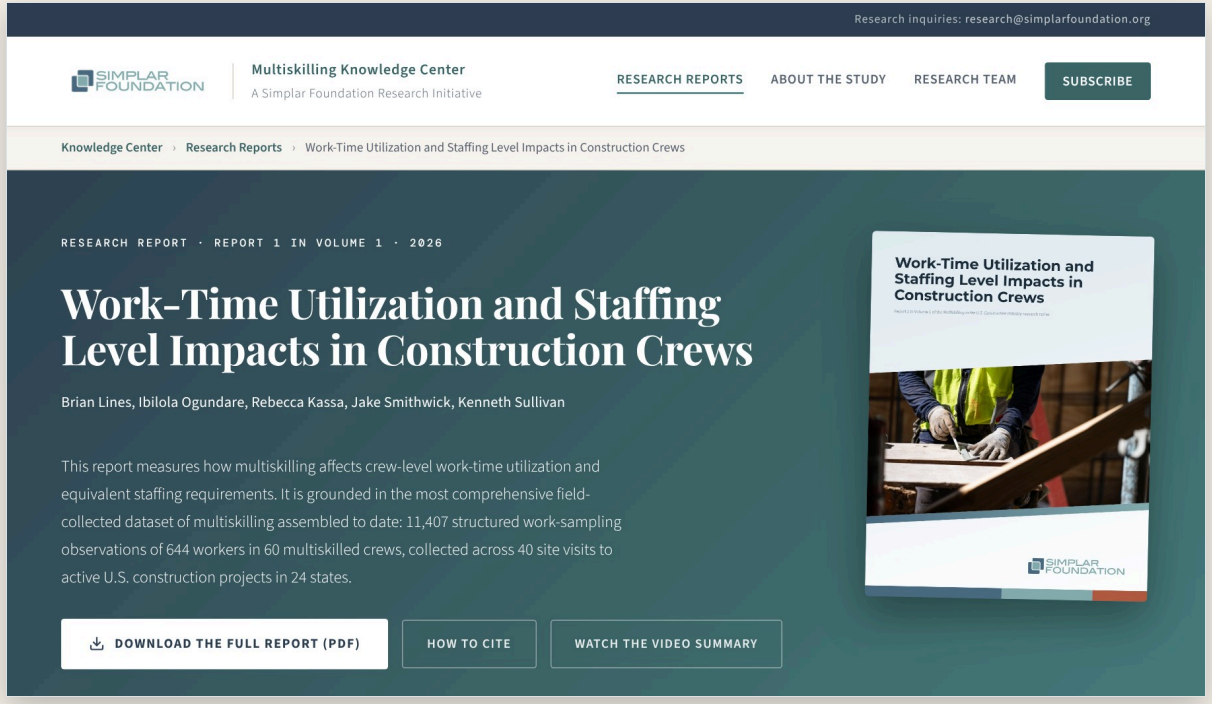
Safety record of the contractors

Contractor Safety Context

33M employee hours of safety records

simplarfoundation.org/multiskilling

Each report page has the full report, a key findings summary and a short explainer video





The Report 1 video summary, on its report page

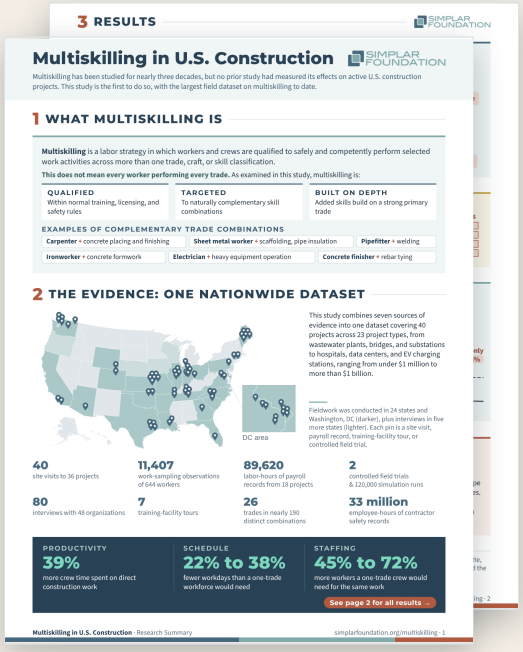
ON EVERY REPORT PAGE

- The full report as a PDF
- Study at a glance
- Key findings
- Video summary
- How to cite

Three handouts with summary information

Research Summary

The whole study on two pages



Practical Implications

A section for each stakeholder audience



Worker Benefits of Multiskilling

In workers' and employers' own words



Appendix B: The dataset

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Seven sources of evidence feed one dataset

NO.	SOURCE OF EVIDENCE	SCALE	WHAT IT MEASURES
1	**Site visits and work sampling**	40 site visits · 36 projects · 11,407 observations	Crew time and crew size
2	**Project labor records**	18 projects · 89,620 core-crew hours · 1,896 workdays	Modeled schedule and staffing effects
3	**Controlled field trials**	2 trials · 11 activities · 120,000 simulation runs	Handoffs and installed work
4	**Interviews**	80 interviews · 48 companies · 18 trades	How employers build capability
5	**Training-facility tours**	7 tours of employer training facilities	Training and verification in practice
6	**Prior peer-reviewed studies**	59 studies · 1998 to mid-2026	What earlier research found
7	**Contractor safety records**	15 contractors · 33.2 million employee hours	The safety context

Fieldwork reached 24 states and Washington, DC, across 23 project types



Fieldwork in 24 states and Washington, DC

Interviews in five more states

Site visits, labor records, training-facility tours and field trials

Projects ranged from under $1 million to more than $1 billion.

23 project types

Industrial, energy and utility

Wastewater treatment · Data center · Substation · Industrial · Prefabrication facility · Fuel · Manufacturing · Power generation · EV charging station

Transportation and heavy civil

Roadway · Bridge · Rail · Heavy civil · Airport

Buildings and public facilities

Hospital · Laboratory · Library · Commercial · Military · Sports and recreation · Hotel and lodging · Amusement park · Multifamily residential

Two field datasets measured multiskilling on active projects

SITE VISITS AND WORK SAMPLING

11,407	2,757	40	36	60	644	30
productivity observations	labor-hours observed	site visits	projects	crews	workers	contractors

Observers recorded every visible worker in the observed crews at random intervals, typically 2 to 5 minutes apart, in sessions of about 2 to 6 hours during normal operations. Crews of 2 to 32 workers.

PROJECT LABOR RECORDS

89,620	10,194	1,896	18	11	183
core-crew hours	core-worker days	workdays	projects	contractors	core workers

Each worker's hours by trade, in 16 daily and 2 weekly records.
Core crew: the fewest workers who together recorded at least 80% of a record's craft hours.
14 of 18 sites visited · 9 public and 9 private · 8 prevailing-wage projects.

26 trades crossed in nearly 190 distinct combinations

26 TRADES REPRESENTED

Carpenter · Concrete finisher · Drywall hanger · Electrician · Equipment operator · Glazier · HVAC technician · Insulator · Ironworker (reinforcing) · Ironworker (structural) · Laborer · Mason · Millwright · Painter · Pile driver · Pipefitter · Plumber · Rigger · Roofer and waterproofer · Scaffold builder · Sheet metal worker · Substation technician · Surveyor · Tile setter · Truck driver · Welder

Equipment operators ran 13 kinds of equipment, from cranes, dozers and excavators to marine vessels, telehandlers and trench rollers.

About 3 trades or skills per multiskilled worker
Up to 6 trades or skills in a single day

EXAMPLES OF INDIVIDUAL WORKERS OBSERVED

2 SKILL CLASSIFICATIONS
Electrician · Operator

3 SKILL CLASSIFICATIONS
Insulator · Scaffold erector · Painter

4 SKILL CLASSIFICATIONS
Crane operator · Rigger · General laborer · Welder

5 SKILL CLASSIFICATIONS
Concrete finisher · Operator · Carpenter
Welder · Reinforcing ironworker

Appendix C: Results in detail

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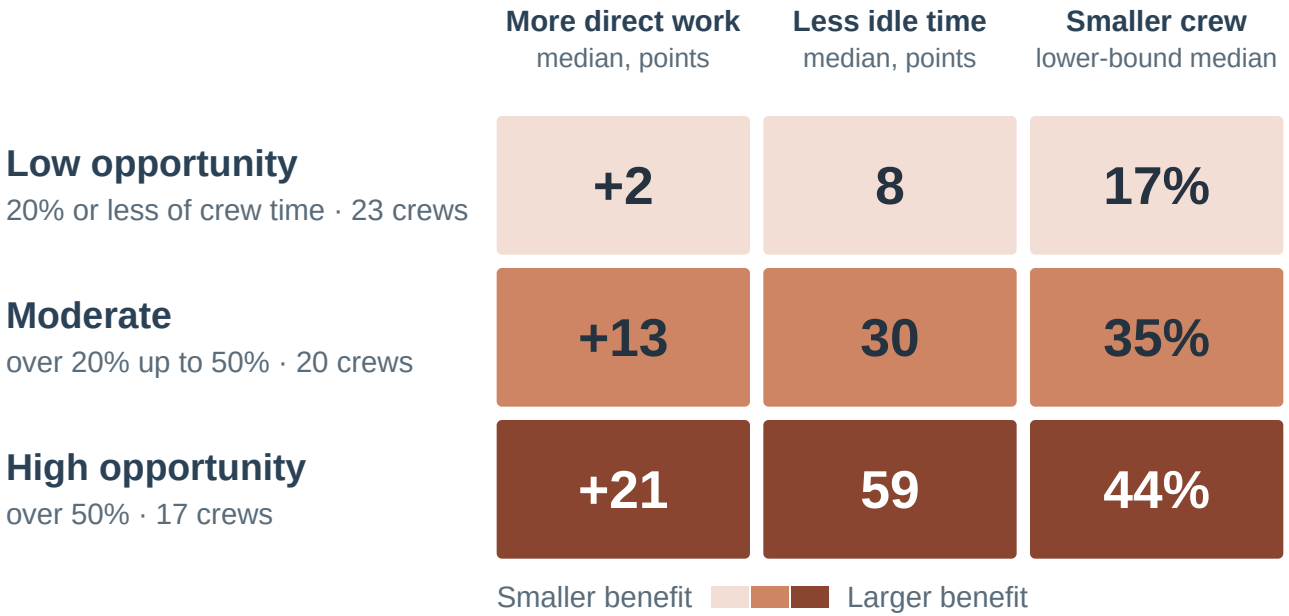
- Trade gaps and the labor curve
- Safety benchmarks

Among the observed crews, the more a crew used multiskilling, the larger the benefit



LOW OPPORTUNITY · 13% MULTISKILLING

Mechanical crew on underground piping at a hospitality facility, crew of 5

+8 points direct work · 12 points less idle · 17% smaller crew

MODERATE · 30% MULTISKILLING

Electrical crew on underground ductbank at a wastewater plant, crew of 4

+22 points direct work · 27 points less idle · 20% smaller crew

HIGH OPPORTUNITY · 96% MULTISKILLING

Concrete finishers on structural work at an industrial site, crew of 7

+63 points direct work · 72 points less idle · 53% smaller crew

Even among low-opportunity crews, 20 of 23 needed fewer workers than their one-trade equivalent.

The controlled field trials built the same assembly two ways

Trial 1: reduced-handoff multiskilled workflow 2 workers · transitions within the crew



Continuous flow, no handoffs

Trial 2: conventional single-trade workflow 12 workers · 10 trade-to-trade handoffs



At each handoff (H), incoming workers typically had to orient themselves, find tools, stage equipment and confirm measurements before work resumed.

PHASE 1 · CONCRETE PAD

1. Drill concrete floor to receive rebar (ironworker)
2. Scarify concrete floor surface (concrete worker)
3. Build rebar cage (ironworker)
4. Build formwork around cage (carpenter)
5. Deliver, pour and finish concrete; strip forms (operating engineer, concrete worker, carpenter)
6. Scarify pad before pump installation (concrete worker)

PHASE 2 · PUMP AND PIPING

7. Deliver pump to point of installation (operating engineer)
8. Install pump (millwright)
9. Measure and cut pipes and support (pipefitter)
10. Connect support to pipes (welder)
11. Place support and complete piping connection (pipefitter)

The model tested 12 handoff scenarios, with 10,000 runs each

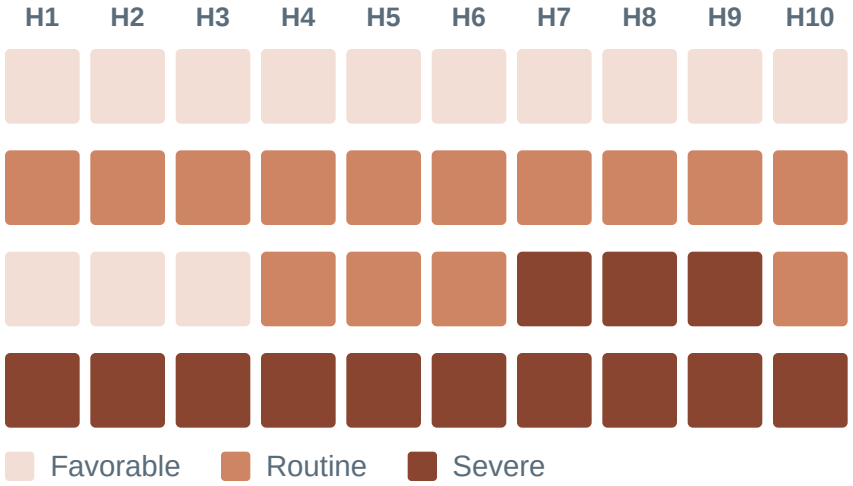
TIME ADDED AT EACH OF THE 10 HANDOFFS

Favorable
5 to 13 minutes, most likely 8

Routine
13 to 60 minutes, most likely 20

Composite
a mix of all three

Severe
1 to 8 hours, most likely 4



PRODUCTIVE-WORK DURATIONS

Half-day	221 minutes of productive work in the trials
1 week	2,400 minutes, scaled from the same sequence
2 weeks	4,800 minutes, scaled from the same sequence

4 handoff conditions	**3** productive-work durations	**12** scenarios	**120,000** simulation runs

Every one of the 12 handoff scenarios favored the reduced-handoff workflow

LESS ELAPSED TIME

	Half-day 221 min	1 week 2,400 min	2 weeks 4,800 min
Favorable 5 to 13 minutes each	27%	3%	2%
Routine 13 to 60 minutes each	53%	10%	5%
Composite mixed conditions	80%	27%	15%
Severe 1 to 8 hours each	92%	51%	34%

Smaller — Larger reduction

MORE INSTALLED WORK, SAME TIME

	Half-day 221 min	1 week 2,400 min	2 weeks 4,800 min
Favorable 5 to 13 minutes each	38%	3%	2%
Routine 13 to 60 minutes each	115%	11%	5%
Composite mixed conditions	397%	37%	18%
Severe 1 to 8 hours each	1,128%	104%	52%

Smaller — Larger gain

The median scenario cut elapsed time 27% and the mean 33%: the basis for about 30% faster and 43% more installed work.

Schedule benefits were found under every schedule assumption and weighting

MORE WORKDAYS UNDER THE ONE-TRADE RULE

Schedule assumption	Theoretically optimal workforce	Observed workforce
Lower bound Each trade works at its own pace	12%	37%
Central (headline) Days in order; spare hours can start the next day's work	28%	62%
Upper bound Days in order; no head start on the next day	93%	130%

READING THE COLUMNS

Theoretically optimal workforce
The same workers, assigned with hindsight to the trades that, taken together, keep the impact smallest

Observed workforce
Each worker limited to their primary trade, the trade they worked most

> **Under the central assumption, every one of the 18 project records needed more workdays with one trade per worker.**

Weighted by core-worker days; the median project gives a similar central range, 26% to 66%. Modeled from 18 project labor records.

Staffing benefits were found on average, high-demand and peak-demand days

ADDED WORKERS, ONE TRADE PER WORKER

share of the base core workforce

Type of day	Theoretically optimal workforce	Observed workforce
Average day mean daily addition	9%	12%
High-demand day 90th-percentile day	17%	22%
Peak-demand day largest single-day addition	31%	34%

PEAK-TO-AVERAGE STAFFING RATIO

peak core-crew staffing divided by the average, weighted across records

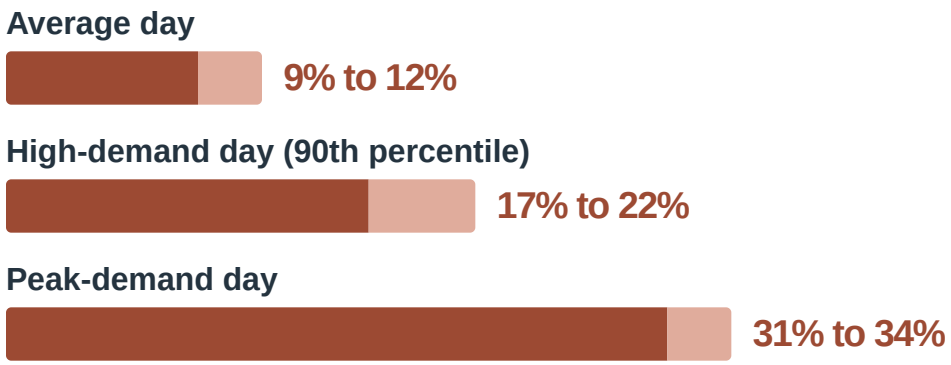
Labor curve	Theoretically optimal workforce	Observed workforce
As recorded multiskilled workforce	1.50	
One trade, peak-demand day (headline) peak raised by the peak-demand-day addition	1.96	2.01

NECA research reports negative project performance impacts above 1.6, a typical productivity loss of about 15% between 1.6 and 3.0, and roughly 20% near 2.0.

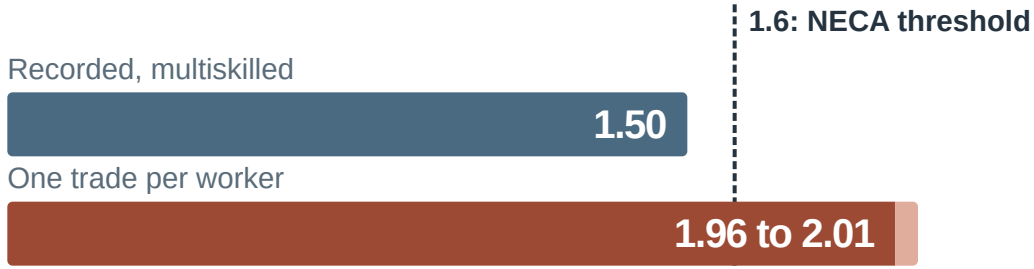
Theoretically optimal workforce: the same workers, assigned with hindsight to the trades that, taken together, keep the impact smallest.
Observed workforce: each worker limited to their primary trade. Modeled from 18 project labor records.

Under the one-trade rule, about 73% of workdays had at least one trade gap

ADDED WORKERS, SHARE OF BASE CORE WORKFORCE



PEAK-TO-AVERAGE STAFFING RATIO



NECA research reports negative project performance impacts above 1.6, a typical productivity loss of about 15% between 1.6 and 3.0, and roughly 20% near 2.0.

About 73%

of recorded workdays had at least one same-day trade gap

12,200 to 15,900

trade-gap hours, 14% to 18% of core-crew hours, that the assigned trade could not cover that day

Each range runs from a theoretically optimal one-trade workforce to the observed workforce. Modeled from 18 project labor records.

The safety records beat both national benchmarks

Recordable incident rate (TRIR)

0.74 Participating contractors

1.72 Benchmark for their mix of work

2.20 All U.S. construction (BLS)

Days away, restricted or transferred (DART)

0.35 Participating contractors

1.03 Benchmark for their mix of work

1.30 All U.S. construction (BLS)

Experience modification rate (EMR)

0.60 Participating contractors

1.00 Experience-rated baseline

SAFETY PRACTICES, 15 CONTRACTORS

Highest available score reported, or use of the practice



123 recordable cases and 58 DART cases across 33.2 million employee hours (16,587 full-time-equivalent workers), with no fatalities. Contractor-reported 2024 records.